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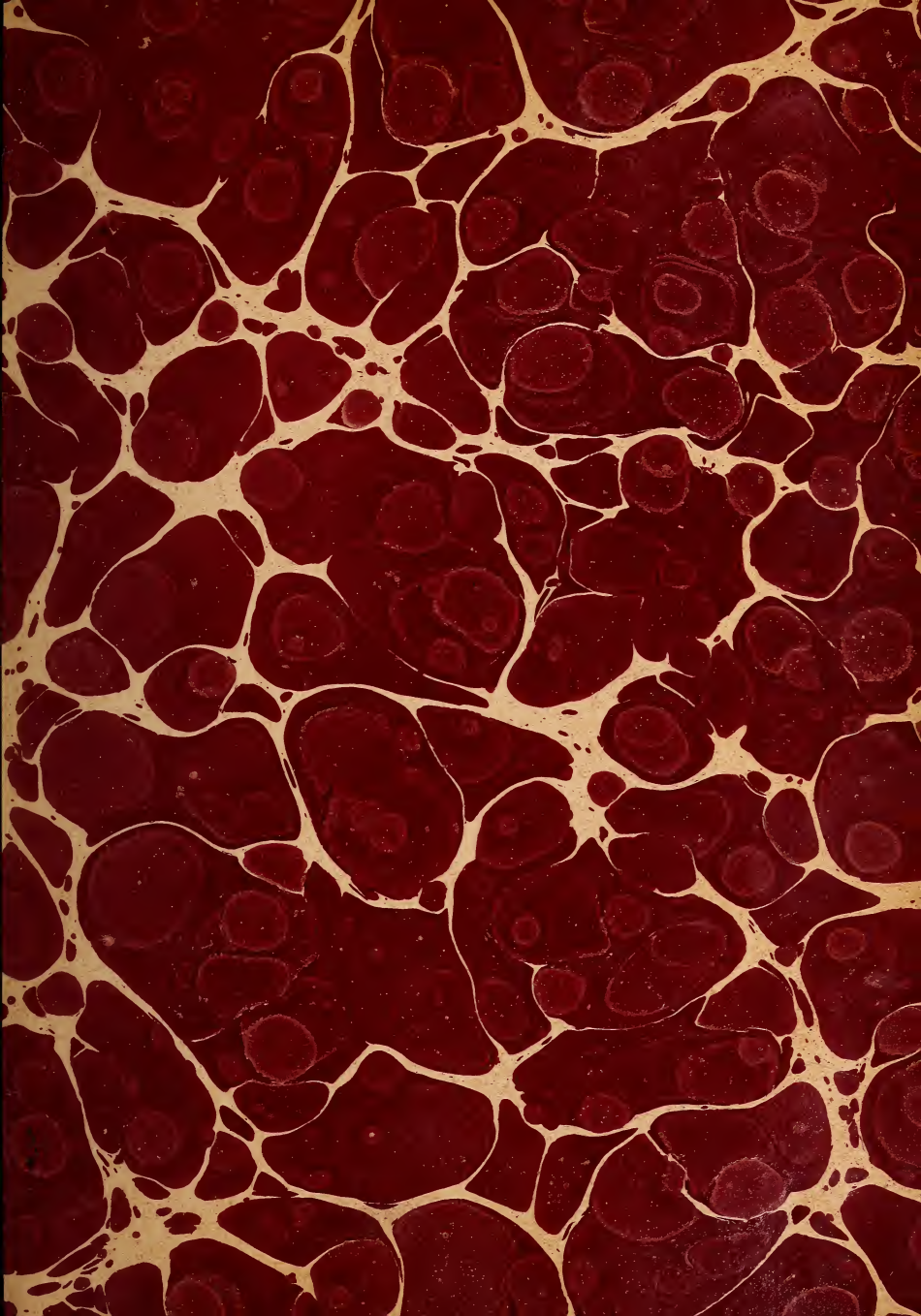


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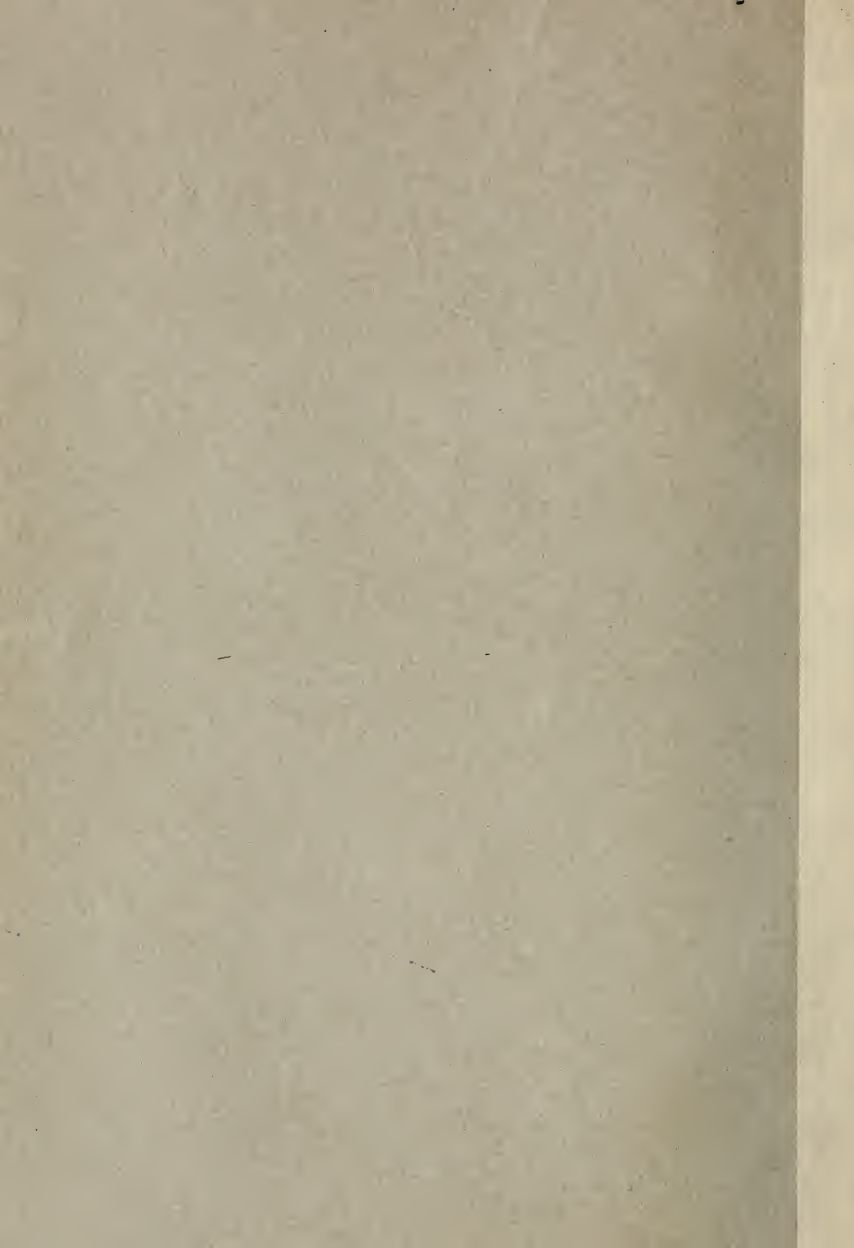
MONT BLANC

THROUGH THE STEREOSCOPE



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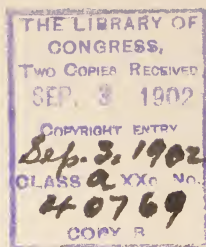
AUTHOR OF "RUSSIA THROUGH THE STEREOSCOPE,"
AND "HOW TO ENJOY PICTURES"



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GETTING READY FOR THE JOURNEY

IF this were to be an ordinary Swiss journey, we should need to consider questions of tickets, trains, boats, hotels, clothing. As it is, we need not concern ourselves about time-tables nor excursion rates, about the choice of inns nor of shoes for Alpine climbing. All we have to do is to consider the special vehicles we are to use,—the stereoscope and stereograph,—so that we may know how to use them in the most profitable and enjoyable way.

It is not enough to take a stereograph in the hand and look at it as we would look at an ordinary picture of the same subject. If we do only this, we get only what an ordinary picture might give us. A stereograph is *not* just an ordinary photograph duplicated and placed beside its "double" on a card. It differs fundamentally from a duplicated photograph. Take Stereograph 49 ("Looking South from the Eggishorn over Rhone Valley") and look at it *without* the stereoscope. Even so, it is beautiful and impressive. You judge there is probably some distance between the nearer rocks and snow ridges and those hazy mountains in the background. Now use your stereoscope. . . . Have you not made some surprising discoveries about the space relations of what lies before you? You do not have to estimate the probabilities of open spaces between things. You actually see the open spaces as clearly as the things; and you see space in places where the mere "picture" gave no hint of its existence.

The difference between an ordinary photograph and a stereograph is this: An ordinary photograph of a given

scene is taken by the use of one lens, giving us just what we might see with one eye from that particular standpoint. A stereograph is taken by the use of two lenses side by side (between two and three inches apart), giving us just *what we might see with our full equipment of two eyes*; and this is quite another matter. The right eye, by virtue of its location in the head, has a chance to see farther towards or around the right side of any solid object before us; the left eye is able to see to a greater extent towards or around the left side of the same object. Using both eyes at once, as we do in everyday experience, we practically see part-way around solid objects.

Try it. Take this very book and hold it (closed) at arm's length, directly before you, the back towards you. Shut the right eye and look with the left only; you see not only the back but also part of the cover on the left side. Close the left eye and look with the right, keeping the book in the same position; you now see the back and a part of the cover on the right side. Look with both eyes; you get an impression of both covers at once as well as the title-back. You practically see around it; consequently it looks solid, as if it had, in truth, thickness as well as length and breadth.

The right-hand print on any stereograph card presents what one would see with his right eye if standing just where the camera stood. The left-hand print on the same card shows what one would see at the same moment with his left eye. The difference between the two views of any distant object is so slight that very often it cannot be detected in the stereograph without carefully exact measurements and comparisons, but the difference always exists. Examine, for instance, Stereograph 69 ("Inn where Napoleon Stopped, Bourg St. Pierre. Road to the Great St. Bernard Pass"). The building in the foreground shows an evident difference between the two

prints. Look carefully at the right-hand *end* of the little one-story building, and you will find it appreciably wider in the right-hand print, narrower in the left-hand print. The right lens or eye of the camera saw farther around to the right than the left lens could see.

Stereograph 67 shows a variation even more striking. See what different reports the two eyes give as to the relation of the clock-face and the distaff.

In ordinary, healthy vision, we are not conscious of receiving two different reports from our two eyes. The mechanism of our visual organs is such that when looking at solid objects in nature, our two impressions get fused into one. When the two prints of a stereograph are in question, we need the optician's help to fuse those two impressions into one. The needed service is rendered by means of the carefully set lenses of the stereoscope. Viewed through the stereoscope lenses, at a distance suitable to one's own eyes (the distance varies with different people), the two prints are seen as a unit and solid objects "stand out" in space exactly as if the reality were present. For all practical purposes of seeing, the reality *is* present. For a curiously striking bit of testimony to the faithfulness of a good Swiss stereograph, just read, in the notes on Stereograph 85, what an English mountain-climber wrote home in regard to the ascent of Mont Blanc from Pierre Pointue to the Grands Mulets.

And we see objects, people, buildings, all details, in their full size. Suppose while standing within six inches of your window you look out and see a man on the street corner, a dozen rods away. He is a man of average height. But if you were to scratch his image on the window pane, just as it lies there, showing how much space that image really occupies on the glass, your drawing would be only a fraction of an inch high. A very small image near the eye thus corresponds perfectly to a much larger object

that is farther away. It is in accordance with this general principle that stereographic figures of men and women, houses, trees, all sorts of things, when seen through the stereoscope, are experimentally identical with full-size objects considerably farther away; that is, if the focal length of the camera, the distance from the lenses to the plate, and the focal length of the stereoscope, the distance from the lenses to the stereograph, correspond. As a matter of fact, the eyes receive from the details of the stereograph, a few inches distant, images of exactly the same size as the images that would be received from the actual things at the actually greater distance, if the observer stood just where the camera stood. When one studies a stereograph, he is therefore practically *looking through the card and seeing the real things, full-size, beyond it*. That is what the experience really amounts to!

One other thing about stereographs should be noted beforehand. When seen, as they should be, through a stereoscope, they fill the whole field of vision. The hood of the stereoscope shuts out all irrelevant sights, leaving us in the presence of whatever the stereoscope has to give us. This separation from immediately surrounding things makes it easily possible to put those out of mind and to think only of what is before the eyes.

It is distinctly worth while to give each stereograph this undivided attention, realizing that, for the time, as far as our inner experience goes, we are actually in the presence of whatever the stereograph has to reveal.

But, unless we have a clear notion of the locality in question, our feeling of actual presence might be partly fanciful "make-believe." It should not be mere make-believe. It should be, and can be, a deliberate, purposeful exercise of the imagination (or the memory), with a basis of accurate knowledge about the lay-of-the-land. The

maps prepared to accompany these Swiss stereographs will be found invaluable helps to clear, correct thinking about the location of each successive point of view and its relation to those which precede and follow. In this Swiss tour we are to take one hundred different standpoints, in various parts of Switzerland. Each one of these one hundred standpoints is plainly located on one (sometimes on several) of the maps, being in each case at the (numbered) apex of a V printed in red. The spread of the arms of the V indicates the range of the view obtained from the standpoint at the apex. Reference to the proper map shows us exactly where we are to locate ourselves mentally; it shows us in what direction we are to look; it shows what must be behind us, what must lie off at our right and at our left. Map 1 gives the whole route, indicating the advance by a continuous red line. Maps 2-11 give more detailed particulars.

Do not fail to use the maps. You will find that the increased definiteness in your understanding of the scenes and the increased vividness of your sense of location will repay you times over for the slight trouble of turning to look for the information they have to give.

The study of a stereograph in the manner suggested here does actually lead one through the mental experience of being in the place itself. This experience is not fanciful, but real. It has to do, not with mere dull, material facts, but with facts of consciousness,—facts of mental attitude and action.

Think a minute what is the nature of the experience which you value most when you visit some place previously unfamiliar. The mere bodily experience of being in personal contact with a certain street pavement or a certain gravel path is not what you value most. The smells in the air, the noises of traffic—these you seldom care to recall in any detail. What is it that you do regard

as most precious? What do you strive, over and over, to reproduce in memory? Surely the experiences that came through your intelligent use of the sense of sight; the feelings you had when you saw with your eyes how

“The splendor falls on castle walls
And snowy summits, old in story.”

And it is precisely this experience, obtainable through the sense of sight, which stereographs give when they are utilized intelligently. As we have just reminded ourselves, we receive absolutely the same visual impressions of the forms of things that we might receive from the material things direct. If to these visual impressions we add a definite, clean-cut knowledge as to what things or places lie at the right and left of our field of vision, if we have some clear notion what is behind us and what lies ahead of us beyond the immediate limits of a particular view (and this is what the figured maps are for), if we thoroughly understand what we are seeing, we do have, to all intents and purposes, the mental experience of being on the spot. We have the feeling of being on the spot. And it is this mental and spiritual experience which counts. The cows feeding on a Swiss “alp” or mountain pasture experience all the physical facts of seeing Swiss scenery, but they never attain to the truer mental and spiritual reality of seeing Switzerland with the mind. The material facts are only the raw stuff out of which genuine realities may be wrought in the workshop of the receptive, active mind.

Of course, stereographs have their limitations. They do not at present give us color. But they do give us, in the most exquisite fashion, what the painter calls “values”—degrees of lightness and darkness corresponding to the luminosity of the actual colors; and, after a little

practice in looking for those beautiful gradations of value, the pleasure to be gotten out of that kind of effects is so great that one can accept the absence of actual hues. Look at Stereographs 13, 14, 15, 16. It is true, we should be richer if we could see actual blues and greens, russets and browns and olives and gold; but we are passing rich even as it is, if we just use our eyes.

Stereographs do not give us the actual, physical sensations of varying atmosphere, temperature, and so on. That is true, and loss is implied in the fact. But it may not be frivolous to recall to mind that there are some advantages as well as disadvantages in omitting the physical experience of winds and waves and arctic cold. If one "averages" the reminiscences of returned travellers, it would appear that experiences of discomfort are those which ordinarily make the deepest impression. We who travel by stereograph have the privilege of counting up some gains as well as losses on this account.

And stereographs do not give us motion. They do give, to a wonderful degree, the effect of motion in some of its most beautiful phases. Take Stereograph 43 ("Beauty and Splendor of the Engadine; looking Southwest from the Hahnensee to the Maloja"), and see if the airy sweep of those light clouds across the sunshiny sky is not absolutely real, to a person with a bit of imagination. Here, again, a certain loss inherent in the fixity of a stereographic print is partially balanced by a gain inherent in the very same fact. How many times have we ourselves said, in the face of some experience direct with nature, "Oh, if this could only last, just as it is!" But it doesn't. The stereographs give us an opportunity to repeat any given experience again and again. We can go back and look up at the Matterhorn as many times as we like and find the selfsame inspiration in its eloquent gesture.

These, then, are our travelling directions:

Consult the maps frequently in order to get a clear idea of your location.

As a rule, it will be well to read the notes about each stereograph before looking at it, returning to the notes as often as may be desired when studying details of any particular scene.

Be sure to have a strong, steady light on the stereograph while studying it. If practicable, let the light fall over your shoulder and on the face of the print.

Take time. Go slowly. Go again and again. It would be impossible to take in at a glance all the interesting and valuable contents of any stereograph in this Swiss tour. If dismissed with a glance, it has not had a chance to give what it has to give.

The study of the stereographs, one after another, on this plan, can give the larger part and the better part of whatever actual travel gives. There are people who make long journeys to famous places merely for the sake of being able to say they have been there. Stereographs will not satisfy that cheap ambition. There are people who go about writing their names on observation towers and chipping little bits of stone off famous monuments to carry home in their pockets. Stereographs cannot be of much use to travellers of that poor sort, either. But, with most of us, the chief satisfaction and joy of travel consist in seeing the grandeur and beauty of "this goodly frame, the earth"; in seeing how the world looks in spots made famous by great events or by men who lived there; in seeing how other men live now, and what sights of earth and sky are woven into their daily life-experience. If this is what we want, the sensible, thoughtful use of stereographs cannot be overestimated as a practical means of enlarging our knowledge and multiplying our delight.

MONT BLANC

MONT BLANC

From different points in and about Geneva one can see, away off to the east, Mont Blanc towering huge and white against the sky. You know Mont Blanc really stands in French territory, not within the geographical limits of Switzerland (General Map No. 1 shows just how the boundary line runs between the two countries); but no visit to Switzerland could seem geographically complete if we did not get some near views of this most famous of all the Alpine peaks. Let us go over, then, from Geneva to the little village of Chamonix which lies just under the mountain. You see on the General Map a section about Mont Blanc marked out for reproduction by itself as Map No. 11, "The Chain of Mont Blanc." *Notice that the section is not made like the others, with its sides facing directly the four points of the compass; it is taken out obliquely, so that the top of our special Map No. 11 will be towards the northwest, the right-hand side toward the northeast.* Now turn to Map No. 11 itself and we have the same region very satisfactorily enlarged. Chamonix is near the middle of the map from left to right, and the point where we are to take our first stand is marked there 78. Trace the red lines which run toward the southwest and you see they take in the summit of Mont Blanc with a large area

of glaciers and rocks between. We must evidently expect to find a good deal of the section we are to see taken up by broad expanses of snow and ice.

78. *Balmat, First to Ascend Mont Blanc pointing out His Route to De Saussure; Chamonix*

We are standing in the village square of Chamonix near the church, and looking a little south of west. The inscription on this monument is quite plain, "Erected in 1887 by the coöperation of the French, Swiss, Italian and English Alpine Clubs, the Appalachian Club of Boston, the Tourists' Society of Austria and the Academy of Sciences, Paris." The group of figures is perhaps a little too commonplace in its realism to be really great as a work of art, but it is at least appropriate as a memorial to the two men whose courage and persistence did so much to make this giant mountain accessible to other people ever since their day.

But we must get in mind the more general features of the mountain mass beyond. The peak furthest to the right is the Aiguille du Goûter, the rounded dome directly before us is the Dôme du Goûter, while we just make out the summit of Mont Blanc away up yonder on our extreme left. The mass of ice that stretches far down the mountain-side is the Bossons Glacier. The two great rocks that rear themselves above the snow near the beginning of that glacier, and in line with the hollow between the Dôme du Goûter and Mont Blanc, are the Grands Mulets, famous

in Mont Blanc mountain-climbing. We are to stand on those rocks later. The usual route to the summit leads right by them. The mountain shoulder beyond the glacier, with snow in irregular ridges near its top, is bounded on the farther side by the Tacconnaz Glacier, which we shall see after a while.

It was only a little over a hundred years ago that the first ascent was made, and a chamois hunter of Chamonix, Jacques Balmat, was the first to reach the summit. He was a man of twenty-five, full of vigor and determination. The Genevese naturalist, De Saussure, had offered a reward to anyone who could discover a practicable route to the top of the mountain. Balmat and another man went up as far as those two black rocks, the Grands Mulets, which we have already pointed out beyond the long, steep slope of the Bossons Glacier; and from that point he made the ascent alone. He told the elder Dumas about his experience a good many years afterward when he was an old man. He had suffered frightfully from the cold and was nearly overcome by the exhaustion of climbing. He had been painfully toiling up and up for hours and was walking along with his head bowed down when, all at once, looking up, he realized that he had reached the summit. He looked all about him, trembling with excitement and fearing that his first impression had deceived him and that he should find some other dome or peak or ridge nearby which stood up higher than the point he had attained; but it was actually true,—the summit was reached and he had no more climbing. It was a spot on the earth's sur-

face where no living creature had ever been before; not even the chamois nor the eagle had been so high. He was absolutely alone, no other human creature within sight or sound. It seemed to him that the whole world at his feet belonged to him. As he said: "I was the king of Mont Blanc; I was the statue of that immense pedestal."

Another impressive view of the mountain can be had if we go up on the Brévent, west of the village, sharply to our right as we stand here, and look across this valley of Chamonix and the river Arve. It is a hard climb up the steep slopes of the Brévent. One can walk up in about three hours or go up on the back of a mule. There are little restaurants and inns high up on the slopes to refresh travellers after their stout exertion. By the way, many mountain-climbers say that when one is toiling up a hard slope of rocks or ice it is sometimes a good plan to carry a small stone in the mouth. There is no occult charm in the stone itself, but under those circumstances one holds his mouth shut and so keeps his throat from becoming dried by the rarefied air, consequently he suffers much less from thirst than he would if he were tempted to open the lips every now and then.

Look at the map once more, Map No. 11, to make sure that the location of the Brévent is clear in your mind. Note the mountain ridge near the upper margin of the map, bounding the valley of Chamonix on the north-west. Our next standpoint is given by the apex of the two red lines on that ridge near the number 79, somewhat to the left of Chamonix.

The guide lines indicate, you see, that our view to the right will be very short indeed,—cut off suddenly by something near us, while we shall be able to look toward the left, a distance of nearly seven miles in a straight line, to the summit of the Mont Blanc range.

79. *Frightful Alpine Precipices,—looking from Aiguille Rouge (Brévent) to Mont Blanc*

As we stand now we are fully a mile above the little village of Chamonix and the bed of the Arve. We are over 8,200 feet above the sea-level. That is the summit of Mont Blanc du Tacul which we see in the distance to the left. Mont Blanc itself is more to the right, though much of the detail of the slopes on either side, and between us and the dome, is covered by those drifting clouds. Everybody quotes here Byron's familiar lines about the mountain:

“Mont Blanc is the monarch of mountains,
They crowned him long ago,
On a throne of rocks in a robe of clouds,
With a diadem of snow.”

The great mass of ice sliding down the mountain-side is the Bossons Glacier again. We get here a better idea of the tremendous fall of the ice toward the valley below. Just to the right of this glacier we see the ridges of snow on the mountain shoulder pointed out from Chamonix (Stereograph 78), and a little farther up we catch a glimpse of one of the Grands Mulets rocks.

Please admire the cool head and steady nerves of the guide up there on that high cliff. He is as little likely to be dizzy as an eagle. It is a truly wonderful command of nerve and muscle that the guides attain, spending their lives as they do in accurate adjustments of muscle and delicate balancing of weight. They learn how to handle their own bodies with as marvellous precision and accuracy as that with which a chemist handles the materials in his laboratory.

We must do more climbing ourselves and get other views of the "monarch" from a point just a little further down. A bit more to the south we can see certain of the Mont Blanc glaciers much more clearly, that is, we can if the clouds keep out of our way. Note carefully the two red lines marked 80 which branch toward the south, directly toward Mont Blanc, from near our present position on the Brévent.

***80. Mont Blanc, Monarch of European Mountains,
from the Brévent***

The summit is that smoothly rounding white dome just opposite where we stand. This whole range that we see now is called by the one general name of Mont Blanc, but several of the peaks which make up the mountain mass have names of their own. It will be specially interesting to identify some of the details now, because, when we leave the Brévent here, we are to pass over and ascend the mountain itself, taking successive standpoints on the way up, looking across and upwards and down, exactly as Bal-

mat and the other mountain-climbers have done before us. We shall make a close acquaintance with many of the features of the mountain that we see now at a distance, and we shall remind ourselves again and again of what we are able to see from here and the way in which particular features of Mont Blanc are related to this whole.

The glacier that we see at the left here is the Bossons again. We shall pass over some of those very ice ridges and watch the guides cutting steps in the solid ice. Then you see that other glacier farther to the right between the two ridges of rock? That is the Tacconnaz Glacier. Following up the line of this dark mountain ridge which separates the Tacconnaz and Bossons glaciers, do you see still higher those small dark points projecting out of the snow and ice, apparently rather near the base of still higher cliffs? Those are the Grands Mulets rocks; they are themselves cliffs of very respectable size, as we shall see when we get nearer to them; and there are impressive views we shall get from the shelter hut which is built on the larger of the two rocks. The map shows them plainly. Look at the map again (indeed we should keep studying it at intervals in close connection with what we see from every standpoint on this Mont Blanc expedition). You see the map sets down that long, steep rocky ridge between the two glaciers as the Montagne de la Côte.

The precipice standing above and to the left of the Mulets is the Mont Maudit. That stands 14,669 feet high. Then comes the summit of Mont Blanc, the white dome at the right, just above two dark, rocky cliffs. The

Aiguille du Goûter is that sharply pyramidal peak at our extreme right, and the rounding elevation above the Glacier de Taconnaz is the Dôme du Goûter. We should get a perfectly distinct idea in our minds of the situation of these points, for it will add a great deal to the clearness of our understanding of what we shall see later. The route taken up the mountain is somewhat circuitous, and we shall see these different landmarks from new points of view.

One of Balmat's first attempts to climb the mountain took him, you remember, only as far as those black rocks at the head of the Taconnaz Glacier. It was there he stayed alone all night without any shelter, nearly blind from exposure to the weather; but a few weeks later he tried again, and actually succeeded in reaching the summit. Nothing serves to discourage a man with the inborn instinct for mountaineering. The successful ascent was made by starting from Chamonix late in the afternoon. Balmat and another man, Dr. Paccard, camped overnight at the farther end of this dark ridge before us at the left, the Montagne de la Côte. Early in the morning they started on again and bore off to the right across the Taconnaz Glacier. Ascents are often made now by bearing off much farther toward the right than Balmat went, going out, in fact, pretty well toward the Aiguille du Goûter. Balmat camped a second night on a little snow plateau away up above the Mulets, and almost to the Rochers Rouges (R. Rouges on the map). Those are the two dark rock masses that you see away up next to the

summit of Mont Blanc. They are not, however, so very near the summit in real fact. There are fully two hours' climbing beyond that point before the highest altitude is reached.

Although Mont Blanc itself is the centre of interest in any view round about Chamonix, still there are other peaks which have nobility and grandeur of their own. If we go over just a bit further to the east here on the Brévent, and look almost directly eastward, to our left, we have a fine view of one of the most picturesque neighbor peaks in this whole valley. Find the lines marked 81 on the map and you see that we shall be looking directly across the little valley of the Arve where Chamonix lies, across the glacier known as the Mer de Glace, and on to a row of peaks standing up out of the Argentière Glacier.

**81. *Climbing the Heights above Valley of Chamonix,—
Aiguille Verte in the distance***

See how tiny the few scattered houses look, away down there in the valley; they are in the outskirts of Chamonix, but the main village is not in sight from here. It is the Montanvert which stands directly opposite us at the other side of the valley. (See Map 11.) That is a favorite excursion point for tourists because it gives a fine view of the Mer de Glace over beyond. It is a part of the celebrated glacier which we see lying between the Montanvert and the Aiguille Verte, the lofty peak that towers above all else. We shall go up on the Montanvert

presently for ourselves and look down upon the famous ice stream. It looks from here at first glance as if that sharp peak over yonder were practically all one mass, but it is not so. The steep, sharp triangle of rock which has comparatively little snow on it is partially distinct from the other. It is the Aiguille du Dru, and you can see by the map that there is an arm of the glacier separating it from the other cliffs. The Argentière Glacier comes down beyond the ridge of the Aiguille Verte; and that is the peak of the Argentière which stands up steeply in the distance at the extreme left.

We shall see the Mer de Glace from two or three different standpoints by and by. Among the others we shall get one view from a point along the side of those steep cliffs beyond the glacier, just above the head of this man who is climbing up the nearer rocks.

We can readily imagine how the spring floods must swell the little river down there in the valley below. Not many years ago the waters were so high that they carried away every bridge but one in the whole length of the valley.

Such a height as this, where we stand now, is really more satisfactory in point of beautiful views than are the greater heights like Mont Blanc's summit. Now we can appreciate the beauty as well as the marvel of this Alpine world; but when one is fifteen thousand feet up in the air, and merely looks down on neighbors like the Brévent and the Montanvert, they are naturally foreshortened into irregular humps. It is like looking down from a church

steeple on the heads of men in the street—the experience is immensely worth while in its own way, but things near by do not show their real beauty.

Doesn't this seem as if we had wings?

Now instead of spending more time looking off at these distant peaks from the Brévent, let us go down to Chamonix and begin the ascent of Mont Blanc. We will follow the ordinarily approved route from the village, going up across the hills at the southeast of the river until we strike the Bossons Glacier. As soon as we reach the glacier, all the climbing has to be done for some little distance on solid ice, and for quite a portion of the way steps have to be cut for a foothold. The heat of the sun, the deposit of new snow and many other things serve to obliterate steps after they are once made, so the labor of the guides in cutting serves only a temporary purpose. Find No. 82 on the map. It is near the foot of the glacier east of the Montagne de la Côte, and we can look up the glacier at that point and watch the men at work ahead of us on one of the sharp ridges of ice which make up this enormous stream.

***82. Ascent of Mont Blanc,—Cutting Steps in the
Crystal Ice of the Bossons Glacier***

We are only at the beginning, and this is comparatively an easy matter, yet the possibilities of disaster are even now thick on either hand. Holes and cracks like those that we see here may, you know, have any frightful depth.

If one sees them and can avoid them, all well and good; but sometimes the mouth of a crevasse is covered by a light snow insufficient to hold a man's weight.

An accident with a peculiarly dramatic sequel occurred on this glacier eighty years ago. Five men who were attempting the ascent were swept away by an avalanche and buried so deeply that it was impossible to recover their bodies. Later, Professor Forbes came here and made investigations as to the rate of movement of the ice mass. He calculated that, according to its rate of motion at that time, it would carry the bodies of the five men down to a certain point in the valley below in about forty years. Forty years later certain relatives, and some scientific men who were eager to test the accuracy of Professor Forbes' reckoning, went to a spot away below us where the glacier melts, and there they actually did discover the bodies of the men, one of them still recognizable, after forty years' burial under the ice.

You see how our guides are protected as well as may be against the danger of any individual fall. They use their rope in the same way as that in which we saw men using it over on a glacier near the Jungfrau (Stereograph 32). The rule is to keep the rope neither very slack nor very loose. There is besides another use for the rope in case of emergency. If one member of a party is swept off over a cliff or down into a crevasse, there must be some means of lowering another man to aid him. For this reason an extra length is always carried by experienced guides. The men have their boot-soles specially prepared with nails to

prevent them from slipping, and their alpenstocks are indispensable. In this particular case no special point is being made of a climbing costume, but sometimes mountain-climbers protect their heads from both freezing wind and blinding sunshine by black linen masks. The glare is something frightful when the sun is bright, and has actually caused blindness where the necessary precautions were neglected.

This is slow work; it sometimes takes a minute to cut a single step. But, though that is a tiresome task, the man who is cutting the steps has really the most comfortable part of the task, for it is likely to be cold work when one merely stands and waits. It was while crossing a glacier over east of here, near the Argentière, that the English mountain-climber, Edward Whymper, stamping to keep his feet warm while his guides chopped steps in the ice, broke through the ceiling of a great ice cavern and narrowly escaped with his life. The one who stands and waits can, however, give his mind to watching for the approach of avalanches, and that is a necessary precaution too, for in an ascent like this there is never any real security against the sudden descent of rocks, ice or snow from above. Guides come to have almost infallible judgment in regard to the reliability or treachery of the snow, and they can usually predict, with the keen accuracy of an American Indian or a Sherlock Holmes, the probable route of the avalanche which is next coming. Still, there are surprises always in the air.

You remember how this glacier looked as we saw it from the Brévent (Stereograph 80)?

There is one spot where a tunnel has been bored into the mass for a distance of eighty-five yards. It is a somewhat ghostly experience to walk in under the ice, as the tunnel invites us to do, but it is practically quite safe, and it gives one a new sensation to think of being down in the depths of this solid river.

83. Tunnel in the Glacier des Bossons, Mont Blanc

If we could look more closely at the ice we should see a good deal of very curious veining and coloring. The geologists say it is caused by the squeezing together and compacting of glaciers of different origin, and by the compacting of ice with snow, though the snow itself has practically been since turned into ice. Then the opening of a crack or crevasse and its filling and freezing again cause variations in the color and beautiful veined streaks when one sees it in section.

There is a point up a little farther on the mountain-side where we can make a few minutes' stay to look off over the further extent of the Bossons toward the Aiguille and Dôme du Goûter. Think how those looked when we saw them from the Brévent (Stereograph 80), and remember that we are now but a very small part of the way up the mountain slope.

Consult the map and find Pierre Pointue on the ridge at the east side of the glacier and still higher up than the ice-tunnel, at the beginning of the red lines marked 84.

We will wait there a few minutes to look off ahead up the way that remains to be travelled.

84. *Ascent of Mont Blanc,—halting with Guides at Pierre Pointue,—looking up Bossons Glacier*

It takes about two hours to climb from Chamonix up to the point where we are now. The Brévent is just about over our right shoulder. There is a house here at Pierre Pointue where one can find rest and refreshment, and its lights can be seen twinkling at night by those who look up from the Chamonix hotels. The Chamonix lights can, of course, be seen up here in their turn.

The guide who stands at the right of this little group is a good fellow, one of the thoroughly reliable men in this region, Joseph Simond by name. The one who is directly facing us is another first-rate man—Jules Simond. As a matter of fact the Simond name is very common among men of this profession round about Chamonix. Whole families, brothers, uncles and cousins, go into the business, and names are duplicated in a rather bewildering way.

A few years ago Frances Ridley Havergal, the English-woman whose hymns are quite widely known, travelled here in Switzerland and went up Mont Blanc as far as the Grands Mulets. She wrote a letter home just after her return to the hotel, and in speaking about the ascent from Pierre Pointue, where we are now, she said: "If you want a good idea of it, study any of those snow stereoscopes with people crossing crevasses and threading among blocks

and pinnacles of ice and looking down into the gulfs. They give an excellent idea of it. I could have fancied I had got into a stereoscope box in a dream."

Now we will follow on over the very route that made this impression on Miss Havergal's mind. That ice-pyramid away at the right is the Aiguille du Goûter, and the round cap is the Dôme du Goûter. This side of the Aiguille du Goûter we see again the upper part of the Montagne de la Côte, with its lines of rock and snow, and protruding above the snow, in the distance, directly in line with the head of Joseph Simond, are the Grands Mulets, and farther to the left, in the distance, directly in line with the head of Jules Simond, we see the rounded summit of Mont Blanc, the place we are bound for. We will proceed with these guides on over the Bossons Glacier, which we see straight ahead of us (note the irregularity of its surface), and up to the hut at the Grands Mulets.

Let us go back to our standpoint on the Brévent (Stereograph 80), where the rocks of the Grands Mulets show like little boulders standing up out of the snow. What we purpose to do now is to cross the glacier as we see it on the extreme left in Stereograph 80, moving toward the right. The point where we shall stand next is numbered 85. It is on the map a little south of Pierre Pointue, and the radiating lines show that we shall be looking about southwest. We shall see the Aiguille du Goûter again at the extreme right and the Dôme du Goûter towards the left.

85. *Ascent of Mont Blanc,—crossing Bossons Glacier Crevasses,—Grands Mulets Rocks, Dôme and Aiguille du Gôûter in distance*

It is only a mile and a half from here up to the Grands Mulets that we see upon our left, but it is slow travelling over the deep crevasses of the glacier, and in bad weather sometimes the passage absolutely cannot be made even by the most experienced guides. What the depth of snow and ice may be here nobody has tried to calculate accurately, but it is certainly many hundred feet. Those rocks that we see just ahead are practically the sharp peaks of outlying hills on the side of the mountain. Their summits come up just above the snow and ice in the same way that the summits of submarine mountains come up above the surface of the water and show as islands.

This is evidently another place where it is wise to look before you leap. One of the most able of the British Alpine Club men said in a book on his Alpine tramps: * “I must say that I object to crawling on hands and knees across three or four feet of snow with a yawning chasm of unknown depth on each side. . . . There are few more unpleasant sensations, I should say, than when one’s legs are dangling in space with unknown depths beneath and with one’s elbows resting on supports which may at any moment prove as treacherous as the part which has already given way.”

* Herbert Marsh; *Two Seasons in Switzerland*.

It is sometimes surprisingly warm when one is climbing here at midday under a summer sun; coats are often superfluous, and if it were not for the absurdity of the situation a sun-umbrella would be gratefully accepted. The guides keep a constant lookout, as they move along, for signs of avalanches either of rocks or of snow. Sometimes, in a steeper climb than this, orders come sharply from the man in front calling for a sudden turn to the right or to the left, as the case may be. It is no time to question why. The order means that a rock is coming, or a snow-slide, and the safe thing is to obey the guide's orders as promptly as one's legs will allow.

Now look again at the map and find a point a little higher up the mountain, farther southwest than our last standpoint; it is numbered 86; you see the apex of the red lines are near the Grands Mulets; we shall be looking westward, away from the summit.

86. Ascent of Mont Blanc,—Ice Cliffs on the Bossons Glacier

It is warm here now. Two of the guides have taken off their coats and are tramping along as if they were going over sun-baked grass or hot, fragrant pine needles instead of over a pavement of ice five or six hundred feet thick. Those masks that they wear to protect their eyes from the glare of the snow are certainly not ornamental, but they save a great amount of real danger to the eyesight. The glare is actually so blinding that those who

neglect taking masks or colored glasses (the guides say masks are the better) are sometimes laid up for days with inflamed eyes, and permanent disability has been the consequence of too long exposure.

As we are looking toward the southwest the mountains in the distance must be in French Savoy, beyond the Valley Montjoie. Chamonix lies sharply off to our right.

It is getting towards night, and we are to sleep at the hut on the Grands Mulets. We are almost there, and the refuge will be a welcome spot. Besides the fatigue of climbing and of crossing the crevasses on the way up, this deep surface snow makes walking wearisome. All the pleasure one gets in these Alpine ascents is thoroughly earned by hard work.

When at last we reach the Grands Mulets we must look about in both directions, ahead towards the summit and back down towards Chamonix in the low valley. First we will climb to the top of the steep little cliff of rock and look off toward the southwest before dark. On the map this next standpoint is given by the apex of the lines marked 87. Again we see by the one short line that our vision will be obstructed on our left. On the right we shall be able to see the Dôme du Goûter.

87. *Ascent of Mont Blanc,—looking from Grands Mulets Hut to Dôme du Goûter,—End of First Day's Climb (Sunset)*

Now we are standing on the very summit of the tallest of those rocks which we saw from the Brévent away up

at the head of the Bossons Glacier (Stereograph 80). The steep Aiguille, which stands just ahead to the left, is put down on our map as you see. Over behind it must be the spot which the map calls the Petit Plateau. That huge, rounding mass, snow-covered except for one little patch of dark rock, is the Dôme du Goûter, and the Grand Plateau, as they call it, is over at the left of the Dôme, beyond the huge snow-bank. We shall go up farther to that Grand Plateau before long.

The hut here on the Grands Mulets has been built for the benefit of travellers ascending the mountain. It belongs to the commune of Chamonix, and the income from it is a public fund. It takes fully three hours to reach here from Pierre Pointue, and the charge of \$2.50 for a night's lodging does not seem excessive. The wonder is how enough fuel, furniture and food can be brought up here to supply the wants of the tourists who take their turns in staying overnight. Not everybody does stay overnight; the ascent can be planned in a different way; but nearly everybody likes to come up here for over sunset and to start out fresh in the morning for the climb to the summit. Since 1850 there have been about nine hundred ascents of the mountain. They keep a record down in Chamonix at the Guides' Bureau, and try to have the figures include all the different excursions. The number varies, of course, from year to year, but there are likely to be from thirty to fifty during any ordinary season.

In the morning we shall leave the cliff on which we stand, and going down to that expanse of snow just ahead

where the tracks show that a party have recently been over the route, we shall turn and look back past these rocks on which we stand and the refuge cabin down toward Chamonix in the valley below.

Find the number 88 in a circle on the map, and then trace the two long red lines which branch from it, one to the upper and one to the right-hand map margin. We ought to get now a great sweep of the Chamonix Valley and the mountains beyond to the north.

***88. Ascent of Mont Blanc,—looking back (north)
to the Grands Mulets Hut (10,007 feet) and
Chamonix Valley***

You see how exactly that cliff of the Grands Mulets resembles the summit of some of the sharp-pointed mountains in this region? It is of precisely the same character as the Aiguilles that we saw when we were looking east across the Chamonix valley and the Mer de Glace (Stereograph 81). It is easy to see now that this is probably an island in the enormous ice-river. How cozily that little cabin is settled there in the cleft of the precipice. The building had to be bolted to the rocks with the greatest security, for you can easily perceive how wind and storm must tear across this slope. We might fancy, at first thought, that it would be wiser to build the hut in some lower position under the lee of the rocks somewhere; but, when we stop to think about it, remembering that avalanches are likely to go sliding down on either side of the rock at almost any time, we remember that it

is much safer on the whole to be high up if only well anchored.

It is too hazy for us to see clearly any details away down there in the valley, but you remember the Brévent is opposite us a little farther to the left. With care, we can make out part of the town of Chamonix down by the Arve in the valley. The mountains farther away are the northeast extension of the Brévent. We are looking in a direction almost the reverse of that of Stereograph 80, and we are looking, too, exactly at right angles to that of Stereograph 81, for the Aiguille Verte and the Mer de Glace are away off at our right as we stand now.

Now we will turn about once more and proceed on the further ascent, for we are bound for the summit, and nothing short of that will satisfy us. A good many tourists find that the ascent to these Grands Mulets is all their courage can compass, but we are to see the whole route and even to look off from the very topmost height toward the Oberland and toward Monte Rosa.

You remember that when we were at the refuge hut (Stereograph 87) we calculated the location of the Petit and Grand Plateaux. Now we are to move on up between these two plateaux. The lines marked 89 on the map show that our next standpoint is to be a few rods distant, from which we shall look over south-westward toward the Dôme du Goûter, which we have already seen from so many different standpoints.

**89. *Ascent of Mont Blanc,—a Mountain of Snow,
between the Petit (11,926 feet) and Grand
(13,000 feet) Plateaux***

Now we see what a snow cornice is, and what horrible peril a man may run into when he ventures out on such a projecting shelf. If one were approaching from below, the shape of the cornice and its danger would be evident; but if he were to come on such a projecting mass from above, where it appears to be an innocent part of the general slope, it would be easy to advance far beyond the safety limit before realizing the facts of the case. It looks from here as if that particular cornice were ready to break off in two pieces now, simply from its own weight.

In 1866 an Englishman, a guide and two porters were going up this very route between the Mulets and the Grand Plateau when they were all swept off by an avalanche. Thirty years later they found the Englishman's body away down at the lower part of the Bossons Glacier, and his watch was actually recovered near the same region only three years ago (1899).

Do you recognize our guide who made so picturesque a silhouette away up on that cliff of the Brévent? His hat is unmistakable. Everybody is seen in silhouette against these expanses of snow. It takes only a little distance to blot out the details of a man's features, when seen against these dazzling ice-banks.

Fortunately this party has fine clear weather for its ascent. Sometimes a mist or a snow-storm will come up suddenly when the guides have not anticipated any such

turn of affairs, and in that case a party may have to wait for hours in practically the same spot. It seems a dismal waste of time, but discretion is the better part of valor in such a case. Imagine climbing that snow slope over yonder in a cloud of thick fog, and walking suddenly off the end down into one of those deep crevasses! No, it is much better to sit still or move about with as short a range of travel as Bonivard had down in his cell at Chillon. A man who can tell stories well is a treasure under such circumstances.

But mountain-climbers get hungry; the mountain air almost invariably gives a good appetite and the guides have plenty of advice to offer about the form in which to take supplies for luncheon. Of course these things have to be planned very carefully, because not an ounce of extra weight must be imposed upon the porters. Even the plainest and simplest of fare is relished after one has been climbing for three hours, and the coarse black bread of Switzerland is delicious here, whatever our opinions of it might be when we were over the French frontier on our way to Paris. Our spot for a luncheon is to be on the Grand Plateau, a level just before the final long pull to the summit of the mountain. Look once more at the map; it is worth while to keep the different steps of the route clearly in mind as they are put down there. The spot where we are to rest for a few minutes is marked 90. We shall be looking toward the summit.

90. *Ascent of Mont Blanc,—Party resting on Grand Plateau (13,000 feet), Mont Blanc in distance*

The height of the mountain lies straight ahead of us at the top of what looks now like a rather low rounding dome. The cliffs at the left are the Rochers Rouges. You find them put down on the map and you remember we saw them above the Mulets when we looked from the Brévent in that outlook to which we have referred back so many times (Stereograph 80). It is interesting to go back to that standpoint now once more, and find the dark rock away up towards the summit. From the Brévent it looks to be just a little below the final height of the dome. Our standpoint now is, as you see, just below that rock.

You remember, of course, what an effect mountain altitude has upon the temperature of boiling water; it is not nearly as hot when it boils here as it would be found if one were getting dinner down in Chamonix. If we were actually to do any cooking with boiling water the practical implications would be rather serious, for it would of course take a great deal longer to complete the process.

It seems bright and sunshiny here now. There are enough men to give us a pleasant sense of companionship, and the tracks in the snow are very suggestive of neighboring humanity. The idea of rest and something to eat is very pleasant in a wholesome, commonplace way; but this Grand Plateau has seen its own tragedies. In 1870 a whole party of eleven men perished here from exposure to a storm. They had spent the night at the Grands Mulets,

and people down in Chamonix watched them through the forenoon at intervals between drifts of snow-cloud. For a few minutes they could be seen plainly climbing up the slopes which we have just traversed; then clouds sweeping over the face of the mountain shut out the sight of them completely. The storm grew fierce and the top of the mountain was covered with cloud for a whole week. The force of the wind was such that it was not safe for another party to attempt the ascent at once, but as soon as the weather moderated enough to make the expedition feasible a party came up to learn the fate of the first eleven. The bodies of five of the men were found frozen to death, and the others were accounted for by a letter found on the person of one of the party, an American. He wrote: "The 7th of September, evening. We have been for two days on Mont Blanc in a terrific hurricane; we have lost our way, and are now at an altitude of 15,000 feet. I have no longer any hope. We have nothing to eat; my feet are already frozen and I have strength enough only to write these words. Perhaps they will be found and given to you. Farewell." They say that in the midst of life we are in death; but nothing makes the truth so real as being in a spot like this, where one party may experience only the most exhilarating pleasure and the next party may all find death in the heart of a snow-storm.

A little farther still up the mountain, on that ridge to the right, farther than we can see, is another refuge hut with buildings partly for tourists' shelter and partly for the making of meteorological observations. Look at the

map again and you find south of the Grand Plateau the Refuge Vallot at the apex of the red lines marked 91. The outlook we are to have from that point is north-north-east and you see the lines indicate that we shall be able to look off to a long distance.

91. Ascent of Mont Blanc,—Refuge Hut des Bosses or Vallot (14,311 feet), looking north to Bernese Alps, Fifty Miles away

As long ago as 1859, when Tyndall, the English scientist, was doing his most energetic mountain-climbing, he came up here with ten guides and camped over night on the summit (just off at our right now) in a tent ten feet square. The men were all sick and forlorn, and the scientific experiments which he meant to make were not entirely successful. Nearly thirty years later, 1887, a Frenchman, named Vallot, came up and camped for three nights. There were nineteen in his party, the number made up by porters bringing supplies. He sent back fifteen of them and four stayed—two men to make scientific observations and two guides to accompany them down. It was through Vallot's endeavors and influence that this hut here was afterwards built on the Bosse or "hump" of rock, in order to make scientific excursions more easily practicable, and to provide a shelter in which individuals might stay over night. The Chamonix people were a little afraid that it would hurt the hut at the Grands Mulets so far as business prosperity was concerned,

and they made difficult terms for the erection of the building, but the plan was finally put through. The materials were brought up by porters who carried about thirty-five pounds apiece. Just think of the route over which they had to come with this building material on their backs! Imagine climbing those ice-heaps that we saw in Stereograph 82, crossing the crevasses in Stereograph 85, and climbing the long steep slopes above the Grands Mulets (Stereograph 89) encumbered by such burdens! It is fully four miles up from the lower end of the Bossons Glacier.

We are looking east of north now. The Grand Plateau lies down behind this cliff at our left. The first mountain on our right is Mont Maudit (14,669 feet), one of the very highest mountains in the Alps, and yet its summit is only a few hundred feet higher than where we stand. A much lower ridge beyond, seen between those two men, belongs to the Aiguille du Midi (12,608 feet), while the loftier ridge, farther away, but distinctly seen, is the Aiguille Verte, the beautiful mountain we saw from the Brévent (Stereograph 81). Fifty miles away we catch glimpses of the Bernese Alps that we already know. Our field of vision from this point is marked out on the general map of Switzerland.

But though the task of building this little Vallot hut was great, as we have seen, the building of the observatory on the very top of Mont Blanc was something still greater. The history of that building is unique. It stands even higher than where we are now and a little to the right. We will turn about and push on to reach the

very summit. See the red lines marked 92 branching toward the northeast from Mont Blanc on the map.

**92. *Summit of Mont Blanc, highest point in Europe,
looking northeast past Observatory to the Bernese
Mountains, Alps***

The very highest point of land in all Europe is the point where we stand now. The first careful measurement of the height was made by an Englishman in 1775. He made it 15,660 feet by triangulation, reckoning Lake Geneva as 1,228 feet above the sea, and Mont Blanc 14,432 feet higher. In 1787 De Saussure made another measurement by means of a mercurial barometer and called it 15,667 feet. The guide-books now call it 15,781 feet. It had for years been the dream of the meteorologists of Europe to have an experiment station on this height, but it was only in 1893 that the enterprise was actually put under way. Vallot, who built the hut lower down (Stereograph 91) established an observatory there and was anxious to have an observatory erected on the summit, but the latter project was put in practical operation by Janssen of Paris, President of the French Academy of Sciences, and Director of the Observatory at Meudon. He succeeded in interesting Rothschild and others, including Eiffel, the famous French engineer, the builder of the Eiffel Tower. Of course they started with the idea of founding the observatory, in the proper traditional fashion, on a rock, and in August and September of 1891 they tunnelled down ninety-six feet through the snow-bed, but even then

could reach no rocks. They dug seventy-five feet farther, probing for rocks, but no rocks still. Then they decided to build the foundations in the snow. Evidently the deposit of snow here on the summit is over one hundred and seventy feet—how much over, it is impossible to estimate closely. In 1892, after a great many experiments here and at Meudon with regard to the sinking of weights in the snow, this observatory building was constructed at Meudon, taken to pieces, transported to Chamonix and brought up here in parts, to be put together again on the spot. The walls and windows are double. The shutters are air-tight and the foundations of the building are so planned that the building itself will stay vertical even if the snow settles, as is likely to be the case. The building was finished in 1894. Most of the materials were brought up on the backs of porters, though some were hauled up by windlasses from one and another available point over intervening slopes. The greatest wonder of all about the building is perhaps the fact that Dr. Janssen himself was seventy years old at the time, and so lame that he was unable to walk readily even on the smooth pavement of a city street. He had to be hauled up like a part of his own materials, partly by the stout arms of porters and occasionally by a windlass! The observatory is a monument to his personal energy and what Yankees call "grit," as well as to the scientific enthusiasm of the French people and the generosity of great capitalists.

Dr. Janssen made a good many interesting experiments up here. The apparatus includes a meteorograph to regis-

ter atmospheric pressure, temperature and the direction and force of the wind. This piece of apparatus is arranged by machinery so that it will work eight months without supervision. A fine telescope was added in 1895. The lowest winter temperature, as recorded by the meteorograph, has been 45 degrees F. below zero. Here on the summit the temperature of the snow, a few inches below the surface, appears to be about 20 degrees F. below the freezing-point. It was through his observations here that Janssen satisfied himself that the oxygen lines in the solar spectrum are due to oxygen in our own atmosphere rather than to oxygen in the atmosphere of the sun itself.

The mountains that we see far away there to the left beyond the observatory are parts of the range of the Bernese Alps. The nearer mountain to the left of the observatory is the Aiguille Verte. Comparing our present view of that mountain with the appearance of it from the hut Vallot (Stereograph 91), it is easy to see that we are at a much higher elevation now.

The snow-covered mountains to the right, just above the slope where the guides have thrown down their ropes, are parts of the Monte Rosa range which we saw during our journeyings about the head of the Visp valley (Stereograph 61-63). The distance which one can see from a summit like this is enormous, but the very fact that we are so much higher than anything else makes the view, in a way, less impressive to the eye; for we lose the magnificent outline of neighboring peaks when we simply look down upon them as now. Perhaps it is only in our imagination

that we can fully realize the fact that this is the highest bit of land in the whole of Europe, higher than Monte Rosa, higher than the Matterhorn,—actually nearer the sky and the sun than any other peak between the North Sea and the Mediterranean, the Black Sea and the broad Atlantic.

But nobody stays long up here on the summit of the mountain. The wind is likely to change at any moment bringing on a blinding storm of snow. We have been exceptionally fortunate in finding the summit clear of clouds and storm. But we too must prepare to go down. The guides will pick up those ropes and harness the party together in customary fashion. They will take up their alpenstocks and make ready for the long descent. The number of hours required for the descent is of course a good deal less than the number needed for climbing upward. They usually reckon about twelve hours' work to get up to the summit from Chamonix, whereas six hours will answer under ordinary circumstances going down. It will take our party something over an hour to descend as far as the Vallot refuge (Stereograph 91), two hours more to get down to the Grands Mulets, another two hours to reach Pierre Pointue, and a final hour for the last scramble down the steep slopes, partly wooded, from Pierre Pointue to the village. Before we go we must signal to the people in Chamonix, for they are always on the watch when parties have made the ascent, and they will answer our signal by the firing of a cannon. If we were to fire a gun ourselves up here,—that is not encouraged on account of the

danger of starting avalanches,—we should be surprised to find what a faint, thin noise a pistol report produces in the rarefied air of this elevation. A signal to Chamonix, then, far, far down on our left, and a moment to wait for the answer; then we will turn back towards home.

Again, we may well be thankful for such magnificent weather. This is no place in which to go wandering about with snow driving in our faces, for the route we have to take lies shudderingly near gulfs that turn one dizzy at the very thought of them. Look on the map northeast of the summit to the lines near the number 93. That is a point just below one of the huge ice-chasms that have to be cautiously avoided on our way down.

93. Descent of Mont Blanc,—enormous Crevasses near the Summit

Our guides will take a circuitous route around this great opening in the side of the mountain, but sometimes it is necessary to descend places as rough and threatening as this. The lightest man generally goes down first; sometimes one of the guides will have himself let over the edge of a snow mass like that up yonder, the others holding him by ropes, that he may see what is below and decide whether it is advisable for the others to follow. If not, they draw him up again and proceed to find a better place in which to descend or cross. Sometimes, in coming down a very steep precipice of this sort, it is necessary to move backwards with one's face toward the cliff, looking

down through between the legs in order to see where to reach for the next foothold!

If we descend by the usual route, we shall go down past the Grands Mulets, across the Bossons Glacier once more, and then go down to Chamonix by way of Pierre Pointue. The very last of the slope, as we approach the village, is through woods and over ferny pastures, warm and sweet-scented. Flowers grow there only a few rods from the everlasting ice, and the sound of brooks running down into the Arve welcomes our return from the skies.

Another excursion which we can take from Chamonix leads us farther over toward the east, to the Montanvert. You remember we saw the dark slopes of this mountain when we were on the heights at the north side of the valley of Chamonix (Stereograph 81). It would be well to return to that standpoint for a few minutes and see again how the Mer de Glace comes down between the Montanvert and the Aiguille Verte. The location of the mountains and the glacier is shown very plainly on our Map No. 11. Almost in the centre of the long map we find the Mer de Glace starting from many tributary glaciers and winding down toward the valley of the Chamonix on the north. We find the Montanvert between the Mer de Glace and Chamonix, southeast of Chamonix, and our next standpoint is marked 94 on the eastern slope, overlooking the glacier. The red lines show we are to look nearly south.

94. *A Remnant of the Glacial Period,—huge Mer de Glace and Grandes Jorasses*

It is a simple and easy matter to come over here from Chamonix if one keeps to the beaten path. There is no danger and no need for any extraordinary physical exertion. This is the most famous of all the glaciers in Switzerland, and we can readily understand why it is popularly known as the "Sea of Ice," for those billowy masses down there certainly do look like the waves of a rushing river suddenly hardened by some magic touch. See what enormous masses of débris there are on either side of the glacier,—the lateral moraines, as geologists call them. Some of those rocks that have been brought down by the slow-moving ice are from twenty to thirty feet square, although the glacier handles them as carelessly as if they were little pebbles. It is again a surprise to find these great streams of ice side by side with summer foliage, flowers, and warm, sunny banks. We can see here in midsummer a fragrant hay crop not more than ten or twelve feet from the edge of an ice-stream that has been in practically the same place for centuries. One man may be wiping the perspiration from his brow in the intervals of mowing a hillside pasture, while another man not more than a hundred yards away may be freezing to death down in the depths of a crevasse. The extremes of winter and summer go hand in hand.

The geologists tell us that the central part of the Mer de Glace moves nearly two feet a day—that is faster than

the sides, because of the lesser friction to hold it back. The movements continue day and night. To give the movement a very homely personal analogy,—rocks in the surface of a glacier are found to have a forward, onward movement, something as spots on a man's finger-nail grow farther and farther out while yet the general shape of the nail seems to remain unchanged.

Look once again at the map and identify the ice-serpent which joins the Mer de Glace, coming in from the right. You see it is the Tacul or Giant Glacier; and the Glacier de Leschaux must be that great white mass that we see in the distance at the extreme left. Can you make out the identity of that tall, jagged ridge of mountains straight ahead of us? Look on the map again, and you see they are put down unmistakably near the lower side of the map, a ridge of sharp-toothed peaks standing in line nearly east and west, the range known as the Grandes Jorasses, that stand guard on the Italian frontier. Again we need to look carefully, for not all those mountain summits we see directly before us are an equal distance away. In fact the somewhat darker mountain rising like a pyramid directly from the glacier stands much nearer us than the line of the Grandes Jorasses beyond. That nearer mountain is the Aiguille du Tacul, found on the map not over two-thirds as far away as the farther peaks. We should notice that Aiguille du Tacul particularly, because we are soon to mount to its summit. There are some magnificent views over there in the neighborhood of the Grandes Jorasses, and

we must get just a few glimpses of that wonderful scenery before we turn our faces away from Switzerland. You see that very dark, rocky elevation at our right, with the glacier coming out from behind it? We will go over beyond and around that mountain, cross the Tacul Glacier and mount to the Glacier des Periades, of which we get just a little glimpse above where the lines of two mountains cross. From that point we can look southwest, back towards Mont Blanc in the distance. Find now the number 95 in a circle near the west side of the Aiguille du Tacul. The red lines show that we are to look back from that point toward the southwest.

***95. Ascent of Aiguille du Tacul,—looking to Tour
Ronde, Mont Blanc and Mont Maudit from
the Glacier des Periades***

Strange how black a human figure looks against this snow! Features are blotted out just as they are when we see a person against a brightly lighted window. It is a fine chance to study characteristic masses and proportions of figures in action. We do not need to see any details of that guide at the right to recognize him as an old acquaintance, for we have studied his energetic silhouette many times since the first glimpse we had, away up on that impossible precipice of the Brévent (Stereograph 79).

The glacier on which we are standing is, we know, the Glacier des Periades. Opposite us is the Glacier du Géant, or Tacul. We know Mont Blanc now, of course. His white

head is unmistakable, looming up directly before us over everything else.

Those slender, steeple-like peaks on Mont Maudit, to the right, are a kind of rock formation very common in the Mont Blanc range. No wonder the French-speaking Chamonix folk call them "needles." In the distance to the extreme left is another of these peaks, La Tour Ronde, but the most striking of all these needle-like summits is the "Giant," or Aiguille du Géant, which we caught a glimpse of at our right when on the Montanvert (Stereograph 94). It stands to our left here, beyond the range of our vision.

We can get the best view of the "Giant" by turning about, crossing the Glacier des Periades behind us, and then looking back southwest from the Aiguille du Tacul. The map shows the direction, in the guide-lines from point 96. Let us go back just a moment to our standpoint on the Montanvert (Stereograph 94) and you can see where it is we are to go. You see that broken, jagged pile of cliffs, just above where the glacier of the Géant and the Glacier des Leschaux come together to form the Mer de Glace, the rugged side of the Aiguille du Tacul? We shall take a stand part way up one of those ice-filled hollows between the mountain's ribs and look off toward the west to the tall, slender spire that just peers over the shoulder of the Aiguille des Charmoz, the nearer slope on our extreme right.

96. Ascent of Aiguille du Tacul—looking southwest to Aiguille du Géant

An angle of just about forty-five degrees, is it not, that we are climbing now? It is well that the leader should be a sure-footed guide. If the man lowest and last in line should slip, that would not be so bad; the others could brace themselves, dig their alpenstocks and axes into the ice and arrest his fall. But if the leader should slip and come sliding back,—well, that does not happen when the leader is a good Chamonix guide.

This is one of the places where climbers have to be on the constant lookout for avalanches. These great *couloirs* or gulfs between the upcropping rock ridges are favorite places for snow-slides and rock-slides. Look! Loose snow has fallen on the glacier's surface over there on the open slope beyond the men! Is it a mere accident of the wind? Is it the sprinkled remnant of some distant avalanche? Can it possibly be the *avant-coureur* of an avalanche down this very gully? No. The guides think there is no immediate danger, considering the present condition of the snow in general, so we will venture to stand here a few minutes to study that strange freak in mountains, the Giant's Needle (Aiguille du Géant), up there on our left. It is an incredible form for a mountain,—as impossible as the Matterhorn without the Matterhorn's awful dignity. Even as late as 1871, when almost all the notable peaks of Switzerland had been scaled, as good an Alpinist as Mr. Leslie Stephen declared it was an im-

pregnable fortress; nobody *could* climb it. Eleven years later (1882) a party of Italians did climb it as far as the lower of those two sharp teeth at the top, and that same summer an Englishman reached the tip of the taller tooth. It is time that the word impossible should be marked in dictionaries "obsolete"! The peak, La Tour Ronde, which we saw from our last standpoint (Stereograph 93) far to our left, is now seen in the distance on our right.

Higher and higher still our men call us to climb up the Aiguille du Tacul. Soon we will pause again and look off toward the north. Consulting the map you see how the lines marking out this next field of vision cross the lines from the Brévent (Stereograph 81) almost at right angles? We are to see some of the same peaks which were visible from standpoint 81, only from another side. Look back to No. 81 for just a moment. There, you know, we saw the Aiguille du Dru standing directly in front of the Aiguille Verte, like a child in front of its mother. Now we are to see the same two peaks from the south side. This time the Aiguille Verte will appear not so much like one sharp pyramid as like the steep ridge of a gable-roof, and the Aiguille du Dru will show its separation from the other summit.

97. *Ascent of Aiguille du Tacul—amid dizzy Heights, looking north to Aiguille du Dru and Aiguille Verte*

How far do you suppose it is across from here to that broken ridge of the Aiguille Verte? Fully four miles in a straight line, and as far to the Aiguille du Dru, there

at the left. We can see now how it was that the smaller peak stood exactly in front of the larger one when we saw them both from the Brévent. Now it is the Aiguille du Moine that stands between us and the Aiguille Verte, and the glacier that we see (over beyond our guide), is the Talèfre. Both this glacier and another that we cannot see, farther to the right, are moving slowly down into the huge Mer de Glace off at our left. The famous "Garden" is over there in the Talèfre,—an island encircled by a wall of débris from the neighboring mountains and surrounded by a sea of ice. For a few weeks every summer Alpine flowers actually bloom there in places where soil has gathered in the clefts of the rocks. A French botanist some forty years ago (1868) enumerated one hundred and nine species of plant life found on this queer oasis in the ice-desert,—the strangest of surprises in a place like this. One expects to dodge descending boulders and showers of loose stones when he is on these mountain-sides. One has his mind made up to watch for avalanches of snow, and for the cracking and falling of enormous icicles; but gathering flowers? Switzerland is full of curious contradictions, for blossoms naturally suggest a landscape smiling and serene, not a bit like this.

Now we can follow the lead of these glaciers, as we would follow the lead of mountain streams, down towards Chamonix. The map shows how they slide down into the Mer de Glace. We will descend the rocks here and let the guides find a practicable route along the glacier back to the Montanvert, from which we looked a while

ago (Stereograph 94). The dotted lines on the map show pretty nearly the track to be followed. Study the map and see how the most desirable path leads along the edge of the glacier at the foot of the Montanvert and then crosses the ice to the point marked 98 in red. From 98 we can turn about and look back once again toward the very spot where we are now.

98. *The "Mauvais Pas" and Mer de Glace, Aiguille du Géant in the distance*

The clouds are always to be taken into account. There they come, filling in the distance and hiding from view the Aiguille du Tacul which we just climbed. It is over behind our good guide Simond as he stands there last in line on the path along the side of this cliff. The iron rods fastened along the rocks here do not mean that the place is especially dangerous as Alpine climbing goes, but only that it is a favorite resort for travellers who do not care for more adventurous scrambling, and so it has been made as easy as possible for ordinary tourists. True, it would be an ugly enough fall from here down to those jagged blocks of ice in the Mer de Glace, but an experienced guide considers this path as easy and safe as walking downstairs. It is only when he feels his way down over a wall of ice-encased rocks, with a distance of two or three thousand vertical feet between him and a glacier-bed, that one of these Chamonix men would begin to feel the pleasant excitement of a risk! It all depends on the accumulated experience by which we measure any new experience.

They tell us here the story of a man who was picking his way along this narrow shelf, years ago, when he met a herd of chamois. It was impossible to turn out. The chamois were many, the man was only one. He lay down flat on the shelf and let the whole herd walk over him!

Perhaps the skies will clear for us if we move on along this rocky way to a point called the Chapeau, a little farther north, down the valley. There is a particularly fine view from that point when the clouds are not lying too low. See; the dotted lines on the map show how our route can be continued to the point marked 99. From 99 we can take one more long look back over the glacier between its high mountain walls.

99. Mer de Glace from the Chapeau; Aiguille du Géant, Charmoz and Montanvert in the distance

We know the Montanvert at once on our right, because it is wooded and green. It was from there that we had such a magnificent view of the glacier with the Grandes Jorasses standing guard beyond (Stereograph 94). You remember how near were those perfectly smooth, steep slopes above the glacier, when we looked off from the Montanvert? Then the Aiguille du Géant was seen just peering over the shoulder of the Aiguille des Charmoz; now the Géant stands out like a tall chimney above the upper end of the glaciers, and the Charmoz shows itself big and clear and sharp just opposite us here. It is only three miles across to the Charmoz, while the Géant is over seven miles away.

Years ago chamois hunters used to camp on this little plateau where we are now; but the chamois are few to-day and tourists take the place of the hunters. Strangely grand and poetic surroundings are these in which to make one's living keeping a restaurant; but the mountain air does make everybody hungry, and the offices of a good cook are to be respected!

It was about here that Forbes and Tyndall made many of their celebrated observations in regard to the movements of glaciers. Ruskin made some interesting calculations, too, about the rate at which mountain streams hereabouts wear away their own smaller beds. He experimented with a little stream only four inches deep, flowing from the Aiguille des Charmoz down towards Chamonix (Chamonix, you remember, is three miles away at our right). He filled bottles with the flowing water from the little midsummer stream, weighed the sandy sediment and made very careful estimates of the volume and velocity of the stream itself. These were the figures he obtained.

The stream carried along about three-quarters of a pound of powdered granite every minute. Calling it thirty pounds per hour, and a hundred-weight every four hours, it would amount to two tons a week,—fully eighty tons a year. This seems to keep well within the limits of a modest estimate. And the stream was only one, a very small one, among many. Its work in the valley, so Ruskin estimated, ought to be considered as multiplied by one thousand to include the work of neighboring

streams;—that makes eighty thousand tons of pulverized rock worn away and carried down from the mountain-sides to the valley just by brooks alone, not counting any of the hundreds of great avalanches that fall every year, and not counting the grinding of the cliffs by this moving sea of ice at our feet.

Is it any wonder that the Rhone is gradually filling in the eastern end of Lake Geneva as we saw it (Stereograph 74), making the lake into a level, fertile plain?

See what strange, fantastic shapes the ice takes here near the end of its bed,—a confused mass of towers and pinnacles and jagged *aiguilles* like smaller editions of the mountains. Do those parallel openings in the ice this side of the Montanvert mean deep chasms? The crevasses down there between those grotesque ice-towers are hundreds of feet deep; sometimes the sound of running water comes up from the unknown space below where lonely rivers run underneath the ice.

Let us take one more long look up the valley while the noon sunshine plays with the peaks and the glaciers. The grass at our feet grows in as cheerful and commonplace a way as if it were beside our own door at home, only a stone's throw from the dramatic terrors of the ice. Here in this mountain inn there is comfort in plenty for exacting humankind, while up on those needle-peaks of the Charmoz and the Géant not even an eagle finds a place for a nest. It is a spot where one's imagination is staggered by the vastness of things and bewildered by the thought of far-stretching ages of time. We cannot quite

take into consciousness the length of years that wind and weather and gravity have been working to get ready for the grass-blades and for us. We cannot quite imagine what changes other centuries may make in this very valley, wearing off the sharp peaks, planing off the precipitous cliffs, till they become rounded like our Appalachian ranges at home. How will it look after the elements have been at work another ten thousand years? And what kind of men and women will be here to see? The problem is too big for us. All we can fairly get hold of now is the beauty of the world to-day. And isn't it glorious?

Shall we go down among those ice-castles of the glacier for our farewell look at Alpine miracles? Then let us choose the spot. At the extremest right as we look now, well out in the heart of the huge stream, do you see a pyramidal tower of ice with some tall, crooked, conical cliffs near it at the left? With the guide's help (and we need it) we can work our way down among those piled-up monuments of ice and look across the rest of the glacier toward where Chamonix lies in its own deep valley. (Look back to Stereograph 81 for just a moment, and recall how the Mer de Glace seemed to cut off the eastern end of the valley of Chamonix when we saw it from the Brévent. Now we are to look from the piled-up ice-craggs of the "fall" at the end of the glacier itself, back towards the same Chamonix valley.)

100. Great Ice-fall at the end of the Mer de Glace

This is the way in which the breaking "waves" of the Mer de Glace dash high at the end of their course through the rock-bound valley! Can anybody figure out the exact force that pulled and pushed the enormous masses of solid ice, piling them up on end like these huge obelisks? Figures are impressive in their way, but here is the real fact. Every cloud that sails over the Aiguille Verte, dropping a handful of snowflakes, pushes just so much harder on this end of the glacier, and keeps the splintered ice piled high in spite of all that summer sunshine and mountain-streams can do to melt it and carry its waters down to the Rhone. Perhaps some particles of this very ice under our feet once made part of a wave, lapping the ships of Æneas as he sailed the blue Mediterranean. It might easily be so. And perhaps the very same particles will some day reach the Mediterranean again by way of the Arve and the Rhone. It is a long, slow journey home!

The old Hebrew poets never saw this heart of Switzerland, but they fathomed the secret of its deepest significance. We have to-day no new phrases that say it half as well as the old phrases:

"Bless the Lord, O my soul, . . . who layeth the beams of his chambers in the waters; who maketh the clouds his chariot; who walketh upon the wings of the wind. . . . The waters go down by the valley unto the place which thou hast founded for them. . . .

". . . Praise the Lord from the earth, fire and hail; snow and vapor; stormy wind fulfilling his word."

OBERLIN, OHIO.

UNDERWOOD & UNDERWOOD.

Dear Sirs :—I have examined with great interest the stereoscopic photographs of the Holy Land, which you publish. They are, altogether, the finest which I have ever seen, and with Dr. Hurlburt's interesting book and the patent maps they enable one to make a journey almost literally through Palestine. I have rarely been so pleased as by these stereoscopic pictures. They will make a trip to the sacred place accessible to those who do not cross the ocean.

Faithfully yours,

(Signed) JOHN HENRY BARROWS, D.D., LL.D.

(*Late President Oberlin College.*)

NEW YORK, April 18, 1902.

UNDERWOOD & UNDERWOOD.

Dear Sirs:—In answer to your favor of the 17th inst., it gives me great pleasure to testify to the value of your stereoscopic views in connection with the teaching of certain subjects of the Grammar School course. I allowed the pupils of my graduating class to use the stereoscope and views, and, judging by the interest and pleasure evidenced by those scholars in examining natural and geographical views, the systematic use of such an instrument would be of great aid to the teacher. It would awaken a deeper interest and result in a more comprehensive knowledge of some of the great facts and truths of the geographical and natural sciences. Those of my teachers who had an opportunity to use the 'scope and views were enthusiastic in their praise.

Very truly,

(Signed) JOSEPH H. WADE,

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I have examined many of the stereoscopic views of Underwood & Underwood's collection, especially those of foreign places with which I am familiar, and they impress me as being excellent photographs and selected with good judgment.

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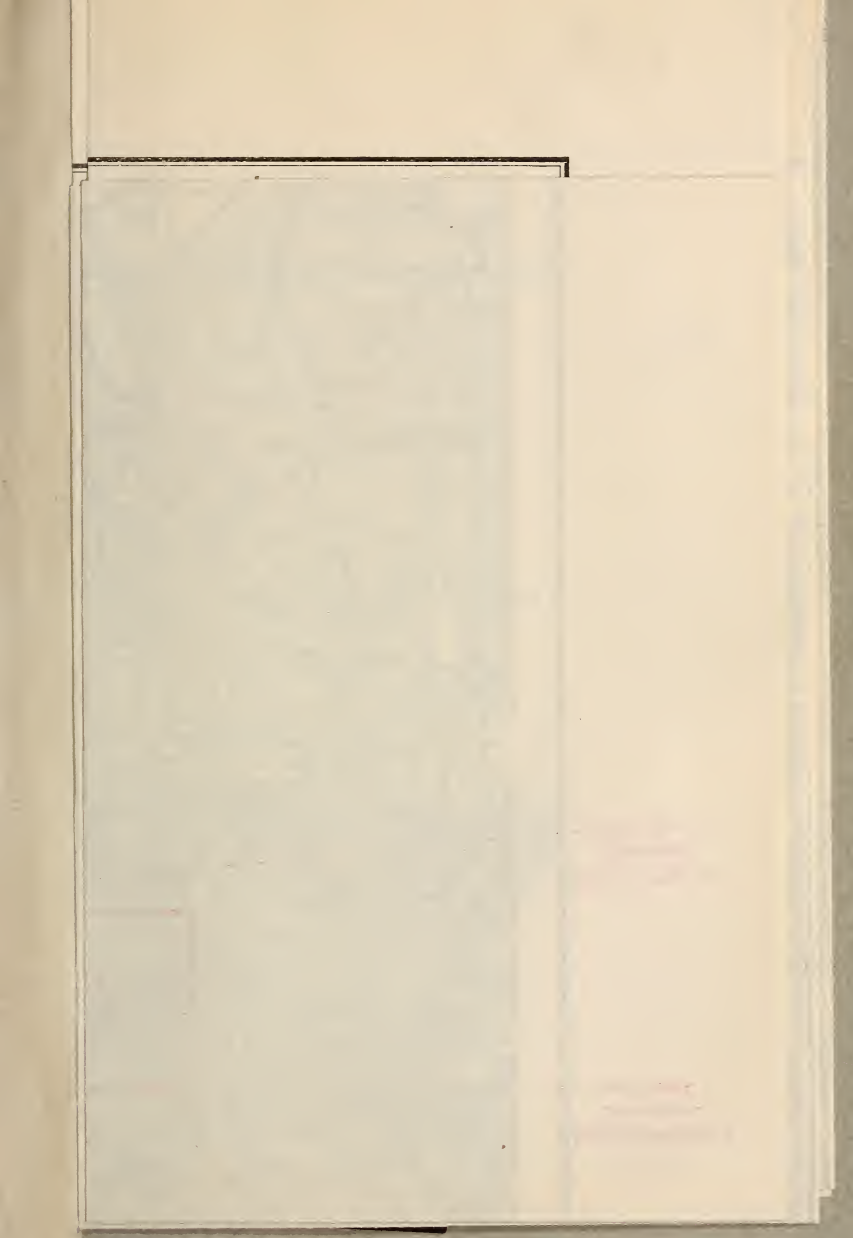
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Yours sincerely,

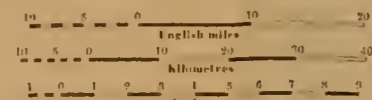
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SWITZERLAND

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— Railways — High Roads — Roads
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Sectional Map No. 3
Stereographs
Nos 6-10

Sectional Map No. 4
Stereographs
Nos 11-21

Sectional Map No. 5
Stereographs
Nos 22-36 & 47-53

Sectional Map No. 6
Stereographs
Nos 54-67

Sectional Map No. 10
Stereographs
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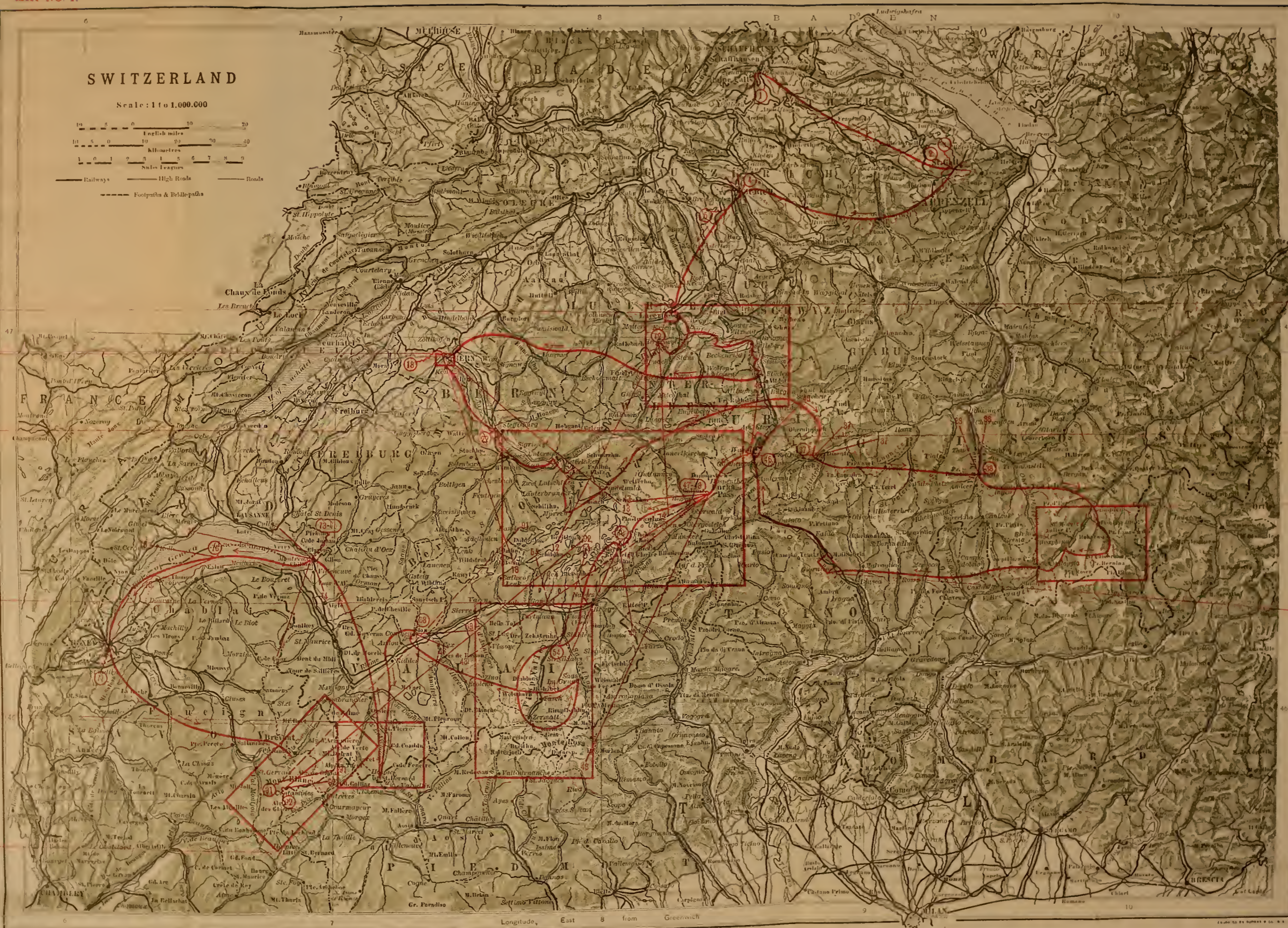
Sectional Map No. 11
Stereographs
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Sectional Map No. 12
Stereographs
Nos 111-120

Sectional Map No. 13
Stereographs
Nos 121-130

Sectional Map No. 14
Stereographs
Nos 131-140

Sectional Map No. 15
Stereographs
Nos 141-150



EXPLANATIONS OF MAP SYSTEM.

The red line with arrows at its ends indicates the general route along which the places to be seen in the stereographs are located.
The red line with arrows at its ends indicates the boundaries of special maps on a larger scale, as specified on the map margin at the end of the line.
The red line with arrows at its ends indicates the territory shown in the respective stereographs.
The red line with arrows at its ends indicates the place from which the view was taken, viz., the place from which we look at the stereograph.

(6) The branching line indicates the limits of the stereographed scene, viz., the limits of our vision on the right and left when looking at the stereograph.
(7) The stereograph number without a circle is frequently placed at the end of each branching line (example 13), to help locate quickly the space shown in a stereograph.
(8) Sometimes the encircled number is placed where it can be seen better and a zigzag line runs to the apex to which it refers.
(9) When some object obstructs the vision on the right or left in a stereoscopic scene the bounding lines on the map are usually continued beyond the obstruction as broken lines.

Patented U. S. A., August 11, 1903. Patented France, March 26, 1903. S. G. D. G. Patented Great Britain, March 21, 1900. Patented in other countries.

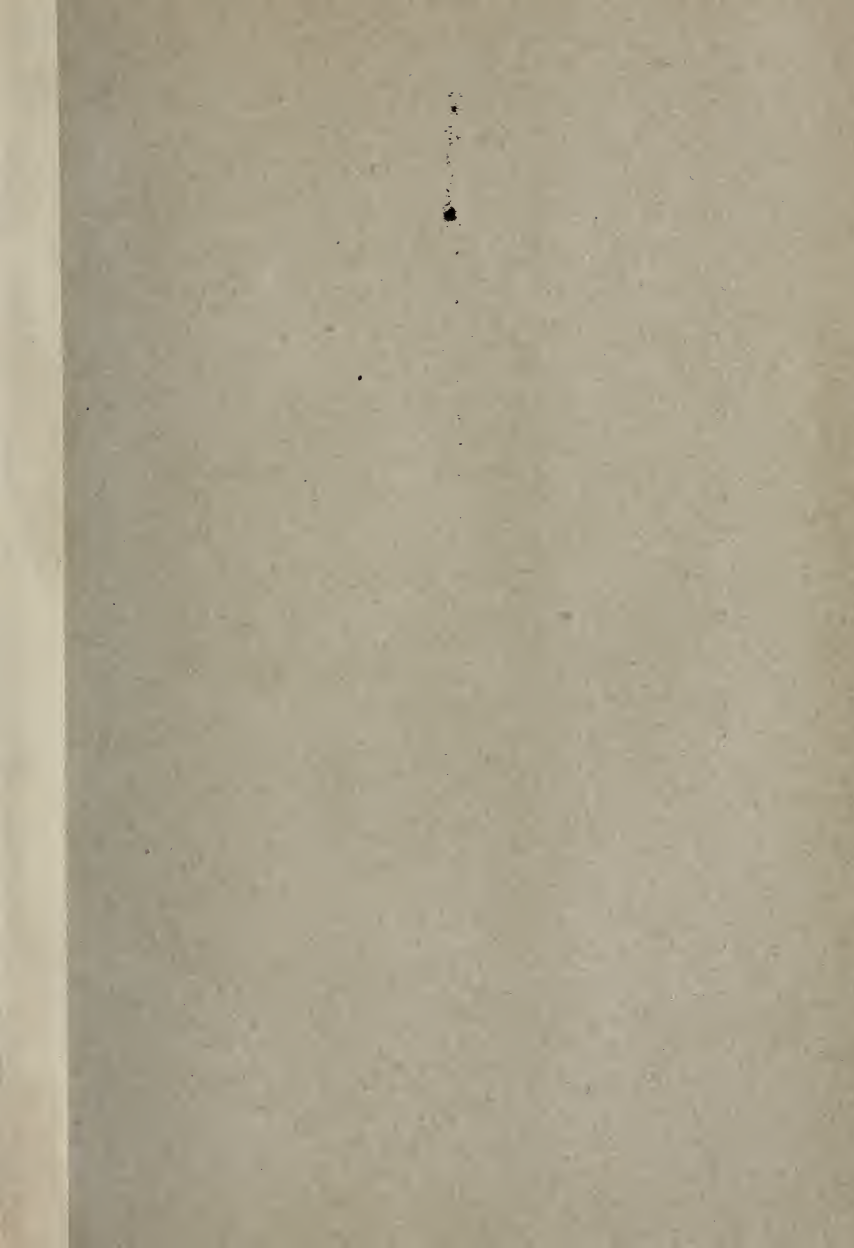




EXPLANATIONS OF MAP SYSTEM.

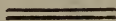
- (1) The red lines on this map mark out the territory shown in the respective stereographs.
- (2) The numbers in circles refer to stereographs correspondingly numbered.
- (3) The apex (<), or point from which two lines branch out, indicates the place from which the view was taken, viz., the place from which we look out, in the stereograph, over the territory between the two lines.
- (4) The branching lines (<) indicate the limits of the stereographic scene, viz., the limits of our vision on the right and left, when looking at the stereograph.
- (5) The stereograph number without a circle is generally placed at the end of each branching line (example 80 < 80), to help locate quickly the space shown in a stereograph.
- (6) Sometimes the encircled number is placed where it can be seen better and a zigzag line runs to the apex to which it refers.
- (7) When the field of view in the stereographic scene is limited, its location is designated by the number of the stereograph in a circle without the branching line.
- (8) When some object obstructs the vision on the right or left in a stereographic scene, the bounding line on the map is usually continued beyond the obstruction as a broken line.

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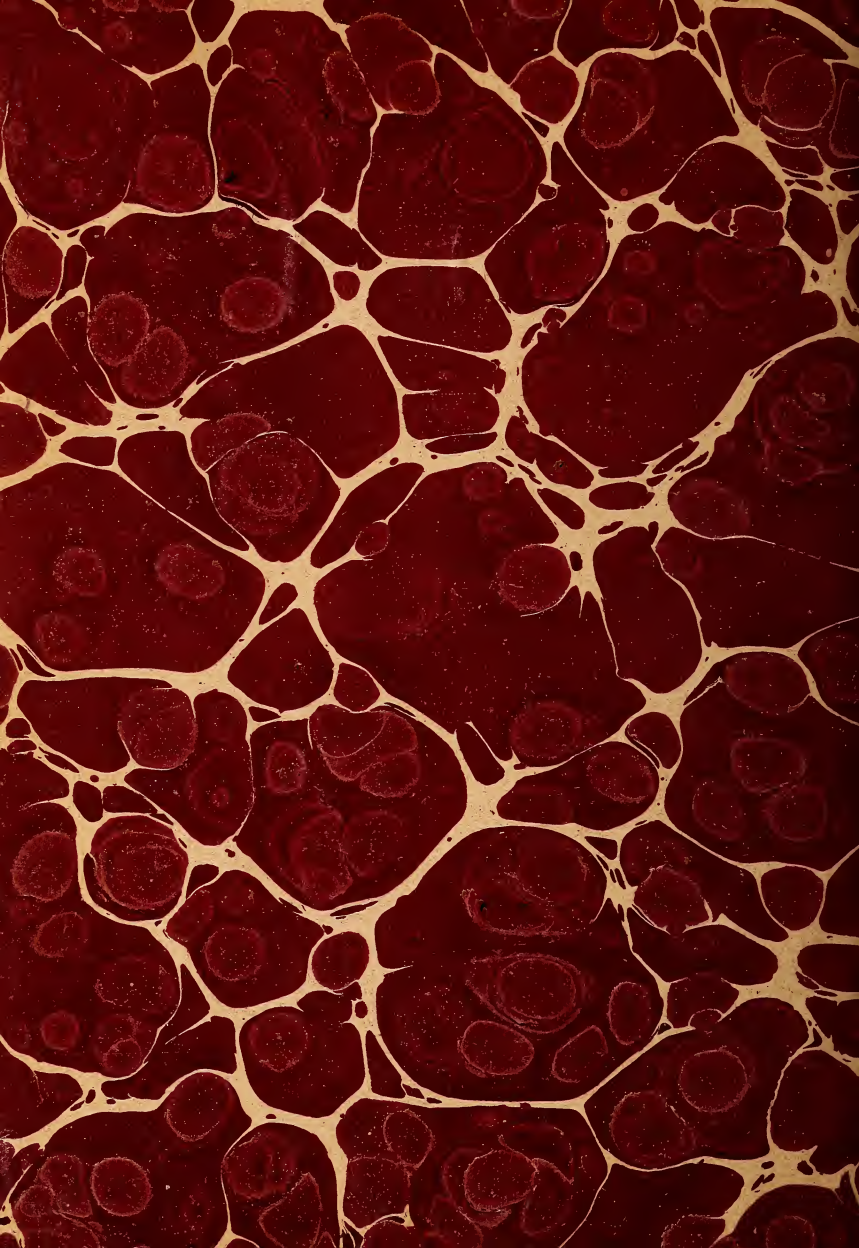
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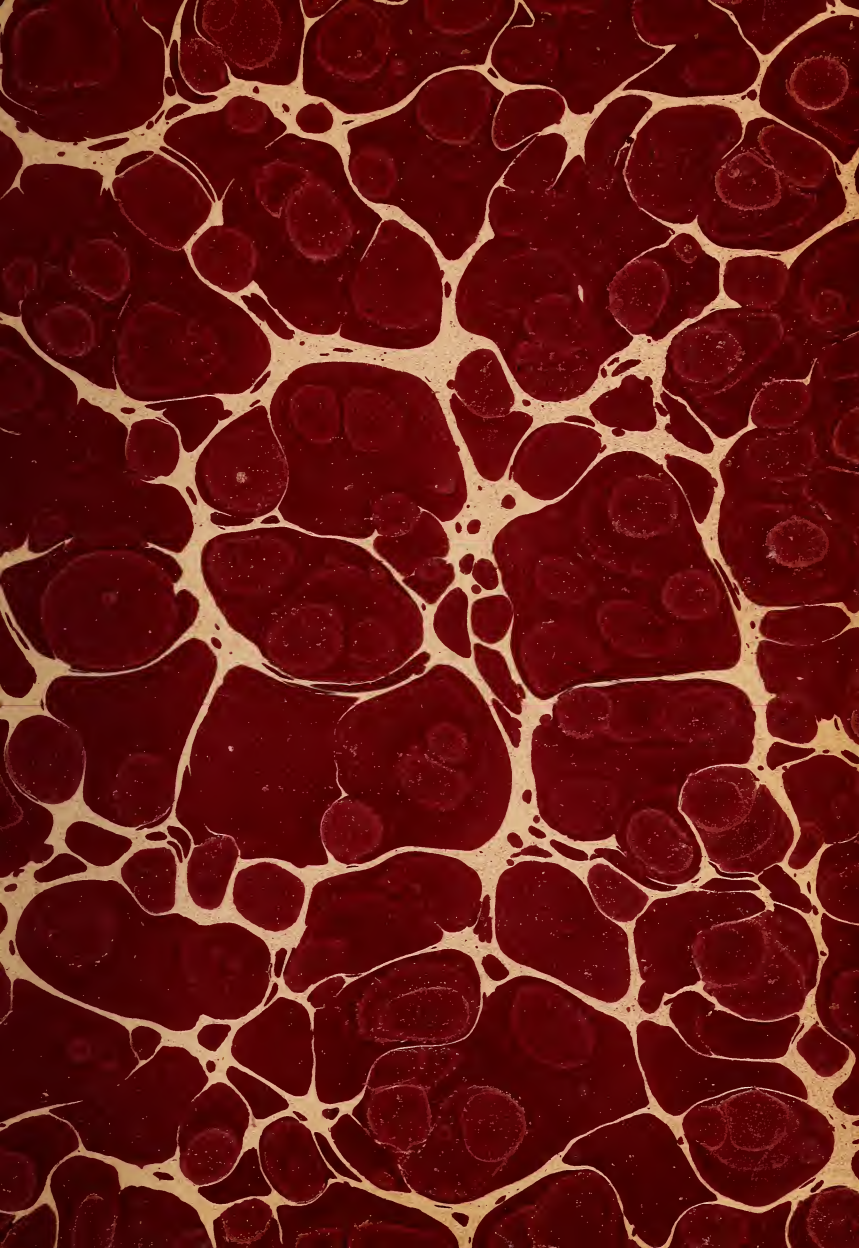
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